VOLUME 32, NO. 1 • THE GEORGE WASHINGTON UNIVERSITY • EDITION 1, SPRING 1985

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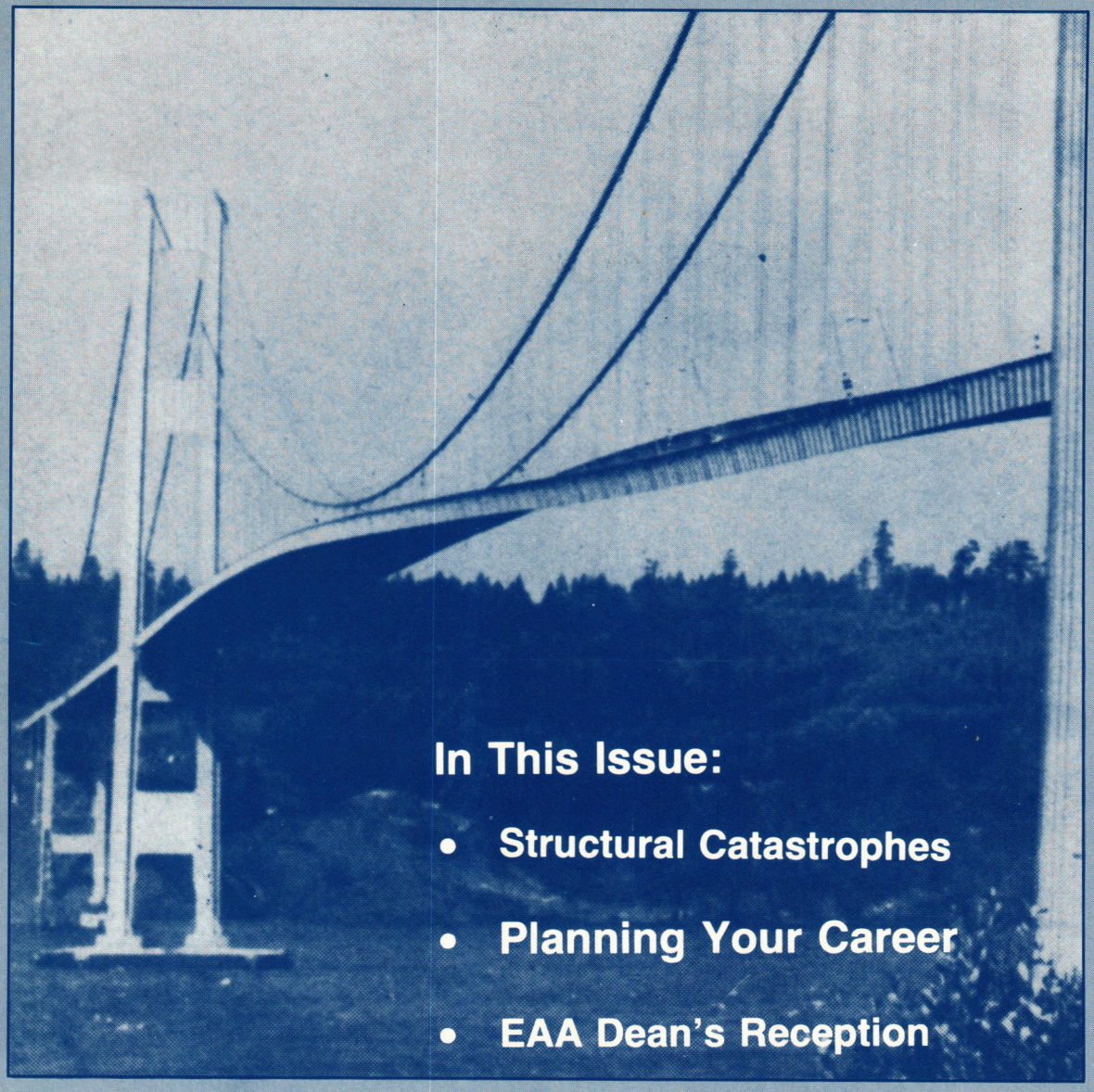
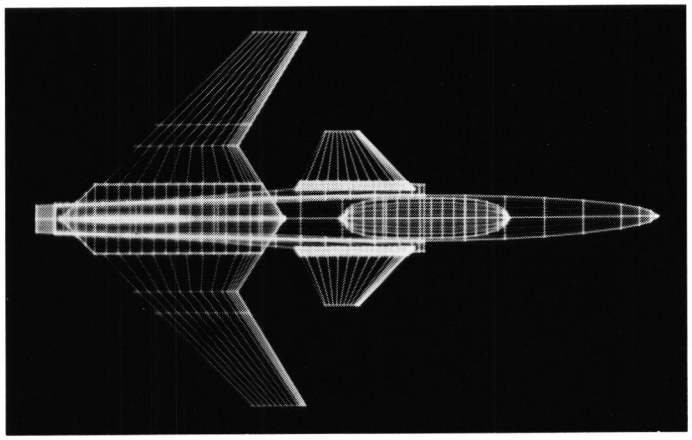


In This Issue:

- **Structural Catastrophes**
- **Planning Your Career**
- **EAA Dean's Reception**

PUBLISHED BY THE ENGINEERS' COUNCIL IN COOPERATION WITH THE ENGINEER ALUMNI ASSOCIATION

Engineering takes on exciting new dimensions in the Air Force



Developing and managing Air Force engineering projects could be the most important, exciting challenge of your life. The projects extend to virtually every engineering frontier.

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You may have the opportunity to join the team that moves the Air Force into the Twenty-first Century.

To learn more about how you can be part of the team as an officer, call toll-free 1-800-423-USAF (in California 1-800-232-USAF).
Better yet, send your resume to HRS/RSAANE, Randolph AFB, TX 78150. There's no obligation.

AIM HIGH
AIR FORCE
A great place for engineers.

VOLUME 32, No. 1 • THE GEORGE WASHINGTON UNIVERSITY • EDITION 1, SPRING 1985

MECHELECIV

Established 1942

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MECHELECIV is a student and alumni magazine published 4 times a year (twice each semester) at the George Washington University by the direction of the Engineers' Council and in cooperation with the Engineer Alumni Association.
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The content of this magazine represents the individual expressions of the authors or editors and does not necessarily reflect the views or attitudes of the student body or of the University administration.

LETTERS TO THE EDITOR

Dear Mr. Kamran:

It was certainly interesting to read, in the second Fall 1984 edition, about the "good old days" of the GWU School of Engineering, and the beginnings of MECHELECIV. The contrast between the rather meager facilities then and those of the School now is very evident. It is analogous to the increase in engineering knowledge between then and now. The administration and staff are to be congratulated for their successful efforts in increasing the support for teachers and facilities, to keep ahead of the ever-increasing demands.

It was interesting, too, to read that in the very beginning in 1884, the School recognized and filled a real need to accommodate students who worked full-time during the day, by scheduling the classes in the evening, from 6:00 to 10:00 PM. This enlightened policy set GWU apart from almost all other engineering schools. It provided an almost unparalleled opportunity for serious students to obtain an engineering education. Many have done this since then, and have gone on to service and success in the Profession. This in itself made GWU's School of Engineering outstanding.

I was one of those serious students, obtaining a BEE in 1943 after seven years of evening classes. Our professors in those years were determined and skilled in teaching us the all-important basic principles of engineering and made best use of the equipment at hand. My overwhelming recollection, however, was that almost all of them, from Professors Akers, Ames, Cruickshanks, and Ennis to Walthur (almost A to Z, and in between), were "on our side". They were caring and considerate teachers, who knew the difficulties we had in working, studying, and meeting the other demands on us, all in 24-hour days.

They often went out of their way to help us by whatever means they could, with willingness and understanding. Those of us who could find the time reciprocated in various ways, such as by serving on the Engineers' Council or operating a voluntary tutoring service through Sigma Tau.

I am sure that I write for many of us in acknowledging that special debt to these men, who also thereby made GWU's School of Engineering outstanding. I hope that wonderful spirit persists and exists in today's professors and instructors.

Sincerely,
F. L. Hermach
BEE 1943

Dear Mr. Kamran:

I enjoyed the fall issue of MECHELECIV very much, since I am a product of G.W. from 1937 through 1948. I am a Theta Tau, was on the Engineers' Council, and served an undistinguished year with the Engineering Alumni Board.

I knew so many of the people you wrote and spoke about in this issue (I still know George Pida), and it brings back so many memories of the joyful (and miserable) nights I spent at G.W.

It's a good magazine — much better and more professional than our old "sheet". I particularly like Bill Ellenberger's historical features. He looked a little younger and less bald when he taught our EE Lab.

Sincerely,
Harold B. Thomasson
BEE 1948

LETTERS TO THE EDITOR POLICY: The opinions set forth in the "Letters to the Editor" page of this magazine are not necessarily the opinions of the staff of the MECHELECIV. This page is set aside each issue for use by students, alumni, faculty and staff of the School of Engineering and Applied Science. MECHELECIV will also accept letters from other sources if the letters concern the magazine or would be of interest to the School of Engineering community. MECHELECIV reserves the right to edit or omit any letter if lack of space deems it necessary, or if a letter appears to be unprintable in the opinion of the Editorial staff. All letters must be signed; however, pen names may be substituted if requested.

GW NROTC

The George Washington University

ARE YOU CONCERNED ABOUT FINANCING THE REMAINDER OF YOUR COLLEGE EDUCATION?

The Navy is offering a different idea in College Scholarships: A two-year Naval Reserve Officers Training Corps (NROTC) scholarship which pays:

1. Tuition costs during your junior and senior years.
2. All textbooks.
3. Lab and instructional fees.
4. One hundred dollars a month stipend during the 20 months of your junior and senior years.

As a student attending a consortium university in the Washington D.C. Metropolitan area, you may participate in the newly established NROTC Unit at The George Washington University. For further information, contact LT. Linver at (202) 676-5880 or write:

NROTC Unit
SAMSON HALL, THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, D.C. 20052

ANNUAL DEAN'S RECEPTION

March 21, 1985
6:00 — 8:00 PM
GW Club
Third Floor, Marvin Center

Dean Liebowitz and the Engineer Alumni Association (EAA) invite all SEAS alumni and graduating seniors to attend the Dean's Cocktail/Buffet Reception on March 21, 1985, from 6:00 to 8:00 PM in the main dining room of the GW Club (across from Ballroom on the third floor of Marvin Center). This annual affair offers engineer alumni a chance to visit with other alumni and with SEAS faculty, staff, and graduating seniors. A ceremony will be held during the reception to present the Engineer Alumni Achievement and Service Awards. Graduating seniors will also be recognized and given a small gift by the EAA. A light buffet table, punch, and wine will be available along with a cash bar.

If you plan to attend the reception, please call the Alumni Office (676-6435) before March 15, 1985, to make a reservation.

Engineer Alumni in the GAA

Five SEAS graduates represent the interests of the engineer alumni on the Governing Board of the General Alumni Association (GAA), which is "a university-wide organization designed to enhance the opportunities for participation by alumni, regardless of School or Division or specific field of interest." Among other things, the GAA sponsors Reunion Weekend each spring and presents Alumni Achievement Awards at the Winter Convocation and Alumni Service Awards at a special awards ceremony, also in the spring.

Last spring, John Manning was elected to serve a two-year term as president of the GAA. John has been active in the GAA and Engineer Alumni Association (EAA) for many years. Other SEAS alumni on the GAA Governing Board are Issa Khozeimeh and Pastor Farinas, who, along with John, were elected to membership on the board, Eric Mendelsohn, member-at-large chosen by the president, and Mary Jones, president of the EAA. As you can see, engineer alumni are well represented on GAA committees, since eight of the ten committees have at least one of our representatives as a member.

Engineer Alumni Given Award at Winter Convocation

Abul Huda Taji Farouki (BEE 1966, MEA 1974) was presented with an Alumni Achievement Award at the Winter Convocation on February 17, 1985. Mr. Farouki is founder and President of the Aegis Group of Companies, which includes the American Export Group, Inc., Aegis Construction Corporation, and Aegis Shipping Corporation, all of which emphasize international trading operations. Aegis has wholly owned subsidiaries in London and Brussels and offices in Cairo, Kuwait, and Amman, Jordan. Mr. Farouki was honored in October 1983 by the Washington International Trade Association, which presented him with its first award for outstanding achievement in international trade. Last March, the Engineer Alumni Association presented Mr. Farouki with the Engineer Alumni Achievement Award.

George Needs Help!

The time has come again for volunteers to help the Development Office with their fund-raising efforts by participating in the "George Calling" Phonathon. The Phonathon will take place this March and April, and engineer alumni volunteers are needed. The Development Office has reserved two nights for engineer alumni: March 6 and March 14. The agenda for each night of the Phonathon is as follows:

— Arrive at the fourth floor of the Marvin Center

— Eat a tasty buffet dinner, compliments of the University

— Receive instructions on what you are expected to do

— Call fellow SEAS alumni and request their pledge of funds for support of the University.

The Phonathon goal for engineer alumni is pledges totaling $25,500. In addition to the two "engineers' nights" in March, you may wish to come in during the open nights from April 1 through April 4. These nights are not reserved for any particular School or Division.

If you wish to obtain more information concerning the Phonathon, please call Serap Akisoglu at 676-6416. In addition, feel free to just "show up" on any night indicated. Your help will be much appreciated.

EAA Schedule of Upcoming Events

March 21st — Dean's Reception (see announcement above)
April (tentative) — Reception and Tour of SEAS CAD/CAM Facility
June 8th — Reunion Weekend.

Structural Catastrophes:

CAN THEY BE PREVENTED?

by Daniel L. Briller

In ancient times, a band of Israelites prepared to lay siege to the supposedly impenetrable walled city of Jericho. Amazingly, the sturdy brick walls crumbled, allowing them to enter unchallenged. This is one of the first recorded examples of technology out of control — humanity's own creative genius turned against itself. Throughout history, people have attempted to lay blame for such disasters on forces beyond their control, such as nature, circumstance, or divine intervention. However, sometimes it is

impossible to ignore the roles human error and human ignorance played in certain of those disasters.

Bearing in mind the engineer's chief obligation is to provide a cost-effective, reliable, and, above all, safe product, let's examine two representative structural collapses of this century. It will afterwards be evident that great and meticulous care must be taken in the design and construction of any structure, and that engineers must always be ready to learn from and correct the mistakes of their predecessors.

The Tacoma Narrows Bridge Collapse
(Gig Harbor, Washington; November 7, 1940)

From the time it opened in early 1940, the Tacoma Narrows Bridge demonstrated an extraordinary flexibility under even moderate wind conditions. Specifically, the deck would oscillate or "ripple", turning many a motorist's stomach and earning the bridge the unbecoming nickname of "Galloping Gertie." These oscillations would occur at varying frequencies, at times displacing the deck as much as 50 inches (4.17 feet) from its rest position. Several measures were undertaken to quell this motion: hydraulic brakes were installed at the base of each tower and 1-9/16 inch diameter cables were strung from the shorelines to points 300 feet out along the span. The latter hardly proved effective, as they snapped, under relatively light winds, some three or four weeks before the actual collapse.

On the morning of November 7, 1940, buffeted by 42 m.p.h. winds, the 2800 foot long main span twisted violently and plunged into the Puget Sound waters below (see photograph on page 4). Until this particular date, the oscillations had always taken the form of smooth, vertical waves moving along the span, from one end to the other. At this juncture, however, both ends developed distinct, out-of-phase oscillations. Superimposed, they formed a single node (point of maximum interference) at the span's center. Here, a faster, twisting oscillation developed, tilting the edges of the roadway more than 45 degrees from the horizontal.

Under this motion, the bridge began behaving somewhat like a long rod or beam under torsion. The stress induced by this back-and-forth twisting soon exceeded the maximum at which the bridge could remain stable. The stiffening girders (lengthwise I-beams running underneath the deck) buckled first, and the vertical suspender cables followed shortly thereafter. Concrete deck sections, some hundreds of feet long, were ripped out and tossed into the bay. Throughout, the towers remained intact but were bent at least 12 feet shoreward, causing the approach spans to sag grotesquely. Wisely, bridge authorities had closed the span before the oscillations became too extreme; otherwise, the loss of life and property might have been farjgreater. Luckily, no one was killed or injured during the collapse.

At first, engineers were baffled by this incident. How could such a well-designed bridge be so fragile? After all, those same vertical suspender cables, which hung the deck from the main cables, had the capacity to endure 6-1/2 times the expected service load. In addition, the bridge was very stiff in the lateral (side-to-side) direction. Even during the most violent rocking, the maximum deck deflection measured in this direction was a scant 2 feet.

The answer was while the bridge was very stiff under vertical and horizontal loading, it was, by contrast, very flexible under torsion. Torsional rigidity of a suspension bridge is directly proportional to the square of its width. While the Tacoma Narrows Bridge was, at the time, the world's third longest, exceeded by only the Golden Gate and George Washington, it was by far the narrowest in this class. The roadway measured just 39 feet across, barely more than half the width (74 feet) of the 2300 foot long Bronx-Whitestone Bridge. Post-failure calculations revealed that the Tacoma Narrows Bridge was anywhere from 6 to 11 times more flexible, under torsion, than the Bronx-Whitestone Bridge and anywhere from 14 to 38 times more flexible than the George Washington.

But the most serious error the design engineers made was failure to consider the aerodynamic, as well as the static, response of the bridge. The oscillations or "galloping" were due to a phenomenon called resonance: a condition at which the amplitudes of oscillation become very large. This condition occurs when the frequencies of forced oscillations (the external force being, in this case, the wind) very nearly match the natural frequency of the structure. In the months preceding the collapse, the most often measured period of vibration was 12 seconds, exactly the natural period of the towers.

The effects of resonance were further worsened by lack of sufficient damping. Additional damping could have been provided in two ways: either by increasing the dead weight of the deck or by adding a stiffening truss (a truss running along both sides of the deck). At this time, the predominant trend in suspension bridge design was to omit the stiffening truss completely, as had been done with the George Washington several years earlier. When the designers of the Tacoma Narrows Bridge copied this, they neglected one thing: namely, the Tacoma Narrows Bridge weighed less than one-eighth as much as the George Washington. They essentially left the bridge with only the 8 feet deep stiffening girders as protection against wind attack. In short, to increase the bridge's torsional stiffness to a degree approaching that of the Golden Gate's would have required an additional 14 feet of width, a 100 percent increase in dead weight, and a stiffening truss 24 feet deep.

The Hyatt Hotel Walkway Collapse
(Kansas City, Missouri; July 17, 1981)

On the evening of Friday, July 17, 1981, celebrations at the KC Hyatt were already underway. Hundreds of people had gathered in the combined lobby/atrium to enjoy drinks and listen to big band dance music. Suddenly, without warning, some overhead walkways caved in, crashing to the floor

and carrying their occupants with them. By the time rescue workers had cleared the debris, the casualty toll stood at 113 dead and 186 injured, making it the then most tragic structural disaster in history.

Public outcry, coupled with some graphic coverage by the press and media, brought numerous investigators to the scene, among them, the well-respected Failure Analysis Associates of California and the National Bureau of Standards. Their cumulative findings centered on one detail: a design modification introduced during construction. They concluded that this change had seriously reduced the load-carrying capacities of the walkways, causing them to fail at loads well below the minimum specified by the Kansas City Building Code.

As originally conceived and built, the hotel lobby was bridged by walkways at the second, third, and fourth floors. All were parallel to each other — the second suspended directly below the fourth, with the third 13 feet to one side. They were supported by pairs of 1-1/4 inch diameter steel rods, at 30 feet intervals along the span. The rods themselves were bolted to box beams (hollow beams formed by seam-welding two channels), upon which the concrete flooring rested. These crucial nut-and-bolt connections, situated underneath each walkway, had an average load capacity of roughly 18 or 19 kips (kilopounds). The collapse initiated when several of the fourth floor connections pulled through their corresponding box beams. Whether this resulted primarily from fatigue-induced deformation or from excessive live loads created by people dancing on the walkways is not certain.

Based on a thorough case history, the NBS team estimated the maximum load on any one connection, at the time of failure, to be 21.4 kips. This quantity might not seem significant in itself, but considering the Kansas City Building Code requirements, it translates to a woeful performance on the part of the structure. The Uniform Building Code used in Kansas City required each connection to carry a minimum load (live load plus dead load) of 40.5 kips, with no safety factor included. This meant the failure occurred at 53 percent of the minimum allowable design load. Adding safety factors of 1.7 for live loads and 1.4 for dead loads generates a design load of 64.1 kips, nearly three times the actual failure load.

This drastic inadequacy in load-bearing capability can be traced largely to a design modification introduced during construction. Original construction drawings called for the ceiling rods to pass directly through the fourth floor connections on their way down to the second. Instead, these rods were terminated below the fourth floor, and a different set, bolted to the box beams several inches away, carried the second floor (see Figure 1). This change effectively transferred the weight of the second floor walkway-rod system to the fourth floor connections, thus doubling the stresses they had to bear. Also, since stresses are generally much greater in the vicinity of holes or bolt connections, this change doubled the number of weak points in the beams, themselves.

Furthermore, no stiffening elements were employed at these already-weakened joints. Post-failure experiments performed at the University of Missouri-Columbia showed that a large washer plate under the nut and a stiffening plate butt-welded to the open end of the box beam would have boosted the typical connection's load capacity to approximately 26 and 36 kips, respectively. While these figures represent improvement, they are still below the minimum stipulated by the code.

Incidentally, the investigators were unable to discover exactly why this change was made. The chief structural engineer for the Hyatt Hotel project claimed afterwards that he hadn't approved it. Nevertheless, the working drawings bore his stamp, as well as those of the architect and building contractor. This is a clear example of the need for constant communication between all individuals involved with a project.

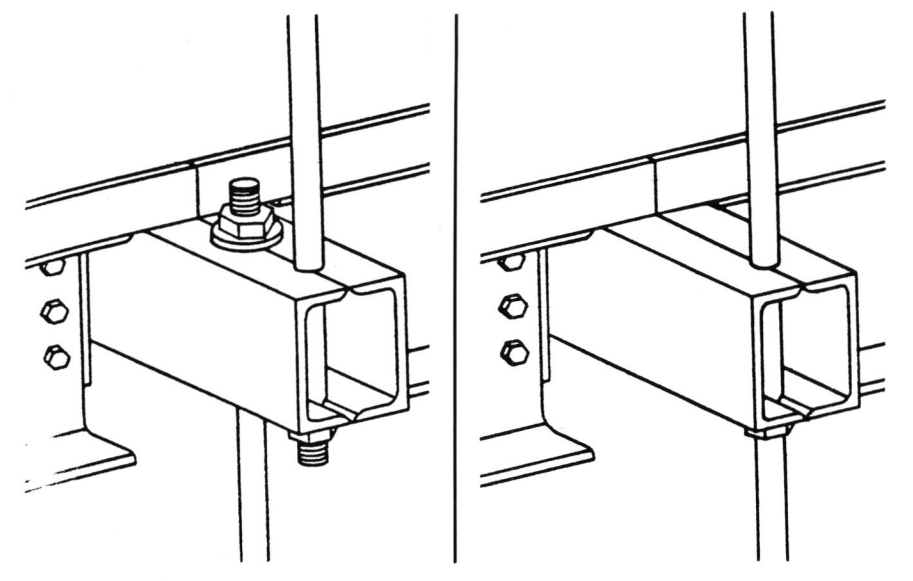


Figure 1: *Illustration of rod-box beam connection as built (left) and as originally planned (right). Notice how original design would have allowed stress to be transmittted through the rod and up into the ceiling. Diagram courtesy of the National Bureau of Standards.*

* * * * * * * * * * *

The reader may be wondering why I chose to include these two seemingly dissimilar incidents in the same discussion (the only thing they appear to have in common is some sort of bridge collapsing!). After all, the Tacoma Narrows failure was an aerodynamic problem — the Hyatt Hotel a static one. The Tacoma failure did not result in human injury — the Hyatt, unfortunately,

did. The Tacoma failure was due largely to ignorance, that is, lack of scientific and engineering knowledge, whereas the Hyatt failure can be attributed to carelessness in design and lack of communication between engineer, contractor, and all others involved.

The heart of the matter is this: with forty years passing, our technology is still every bit as vulnerable to forces capable of destroying it. Four hundred years may pass, and this will still be true. Therefore, we engineers must always be exceedingly conscientious about, and demanding of, what we design. As stated earlier, our duty is to provide society with the safest, most efficient products. Thus, we must strive to eliminate every flaw our knowledge permits us to eliminate, giving those destructive forces as little chance as possible to threaten our lives and our engineering masterworks.

* * * * * * * * * * *

Author's Note: *Both structures discussed here were subsequently redesigned and rebuilt. The Tacoma Narrows Bridge was expanded in width to 50 feet, loaded with 50 percent more dead weight, and given a stiffening truss 33 feet deep. As for the Kansas City Hyatt, the walkway design was scrapped entirely, in favor of a single platform, supported by 10 concrete columns.*

Daniel L. Briller is a junior scholarship student, majoring in Mechanical Engineering. He is assistant editor of the MECHELECIV and a member of the student and national chapters of ASME. A participant in GW's co-op program, Daniel is currently employed in the Fracture Mechanics section of the Naval Research Laboratory.

A Good Job is Worth the Effort

by

Greta Prairie Clinton

and

Ken Everingham

Career Services Center

It's easier to find a job with a technical degree, but will it be a job you will enjoy? Chances are it won't be, unless you determine who you are and who wants you, before you apply.

If you're an electrical engineer, do you want to design computer hardware or sell it? If you're a civil engineer, do you want to build bridges or assist in designing a wildlife sanctuary? These decisions are based on your skills, values, and interests.

The George Washington University Career Services Center can help you answer the question, "what do I have to offer?" The workshop, "Organizing Your Career Search" takes participants through a self-assessment process. By the end of the workshop, they have developed criteria consisting of their top five skills, values, interests, and personal qualities. The ideal career choice would incorporate these criteria. Other excellent "self-assessment" materials may be found in the Center's Career Resource Library. Ken Everingham, Assistant Director and liaison to the School of Engineering and Applied Science, and other career counselors are available to discuss specific questions.

Once you know who you are, you're ready to tackle the question, "who wants me?" This entails examining the marketplace for organizations which provide opportunities closely matched to your skills, interests, and abilities. For instance, once you've decided you want to work for a large firm doing research on robotics, the field is suddenly much narrower. You need to find out who's out there doing the things you like to do. The Career Resource Library houses reference books on the engineering industry. The career information coordinators and career counselors will gladly show you how to develop contacts in industry.

Now that you know who you are and who wants you, you can begin your job search campaign. The Center can help you polish your job search techniques, from critiquing your resume to teaching effective interviewing skills. Several hundred employers visit the campus each year to conduct preliminary interviews. If you are within one year of graduation and have registered with the Center, you are invited to sign up for appropriate interviews. Last year, over 70,000 full-time jobs were listed through the Center's full-time job listing service. A new service, "Jobline," a 24-hour job telephone line at 676-8636, lists engineering and computer science positions every Wednesday and Thursday.

Career planning means more than just getting a job. It's answering the two questions, "who am I?" and "who wants me?" A good job is worth the effort. The payoff comes every hour of the day. For more information, call the Career Services Center at 676-6495.

Department of Civil, Mechanical, and Environmental Engineering (CMEE)

NON-STEADY FLUID MECHANICS

Professor J.V. Foa 676-6149
Professor C.A. Garris 676-3646

When a high energy fluid impinges upon a low energy fluid, energy transport processes usually occur which tend to equalize the energy level of the two bodies of fluid. When such interactions involve pulsations, or non-steadiness, it is possible to achieve this transfer of energy with minimum possible dissipation of energy.

The CMEE research activity in this area centers on two principal applications of the above: Jet Propulsion Thrust Augmentors and Energy Separation.

The experimental work is carried out in the Propulsion Laboratory. The Laboratory is well equipped with various air supplies, laser velocimetry equipment, high-speed photography equipment, flow visualization equipment, and computerized data acquisition.

The group presently consists of twelve people, including undergraduates, Masters and Doctoral students. Undergraduates participating in the Honors Research Program, or those interested in research, are encouraged to join the group's activities. Weekly research meetings are held and interested students are welcome to attend.

STRUCTURES AND DYNAMICS

Professor J.N. Yang 676-6883
Professor G. Arkilic 676-7190

The graduate Structures and Dynamics Program of the CMEE Department offers a variety of courses in solid mechanics, structural dynamics, random vibration, structural reliability, fatigue and fracture, etc. Emphasis is placed on interdisciplinary areas, such as reliability, failure analysis, etc.

Currently, five research programs are being conducted:

(1) Random Vibration of Rotating Machines Under Seismic Excitation;
(2) Active Control of Civil Engineering Structures Under Earthquake Excitation;
(3) Stochastic Approach to Metal Fatigue with Application to Durability and Damage Tolerance Analysis of Aircraft Structures;
(4) Statistical Characterization of Metal/Composite Joints, and the Stiffness Degradation of Composite Laminates (with Prof. D.L. Jones);
(5) Initial Metal Quality Representation.

In addition, joint research efforts with industrial companies are also available. Students in both MS and DSc programs are trained to conduct research and development in various new frontier areas. The research group presently consists of many doctoral candidates and several assistant research professors. Details concerning each research program can be obtained from Professor J.N. Yang.

Department of Operations Research (OR)

GRADUATE PROGRAM IN MANAGEMENT SCIENCE

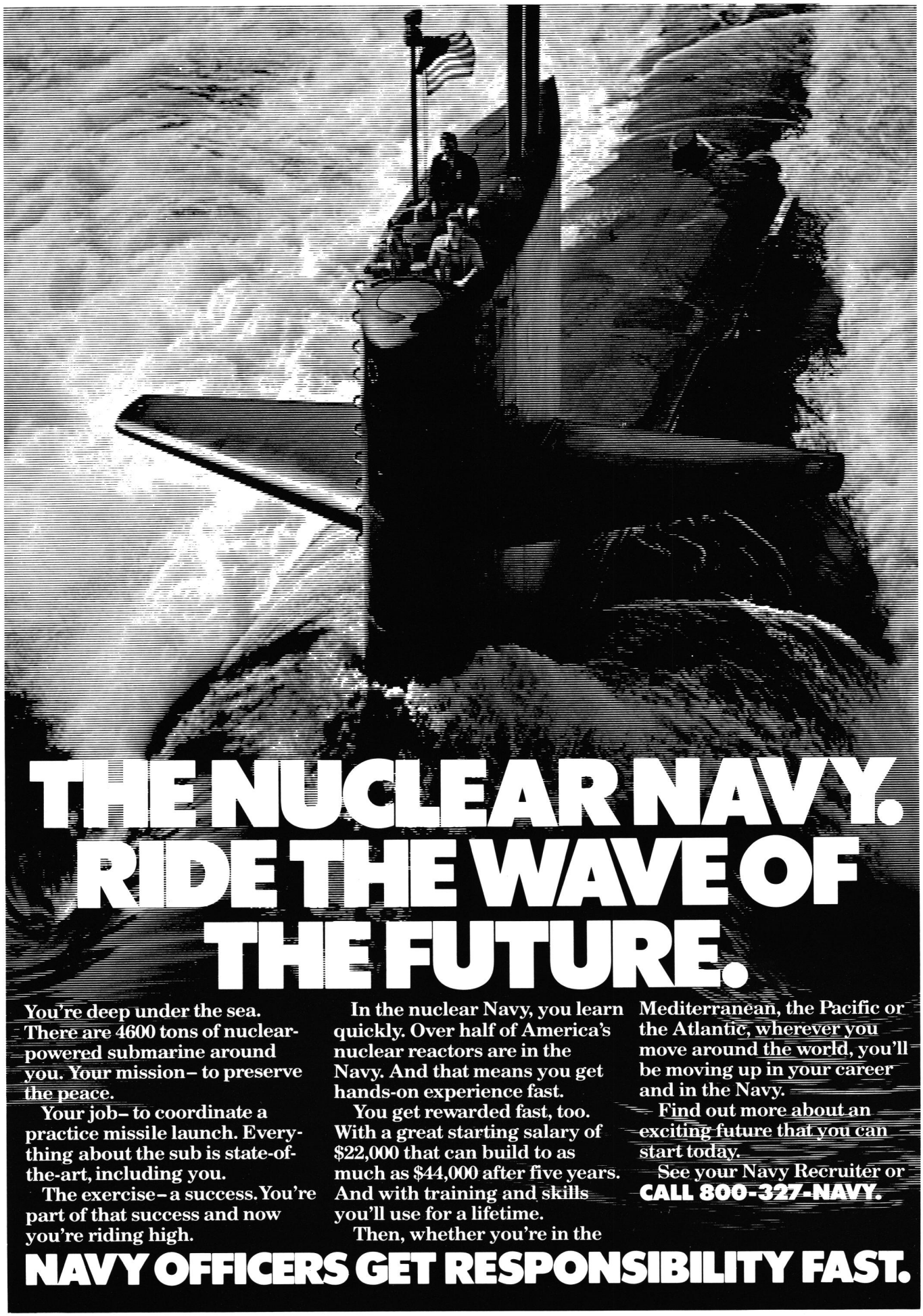
The Department of Operations Research is going to offer, beginning in the fall semester of 1985, what is essentially a new master's program. It is called the Master of Science Program in Operations Research with a Concentration in Management Science, and its objective is to prepare students to utilize the quantitative techniques of modern management. This program emphasizes a thorough understanding of quantitative approaches to problems of managerial control and decision making. While the program develops background in the basic mathematics associated with various techniques, it is oriented towards the quantitative modeling of decision and control problems and their solution by application of the techniques in the form of modern management science software. This program stresses the efficient use of such software and aims to prepare the students for effective administration and use of operations research.

The M.S. Program in Operations Research with a Concentration in Management Science has somewhat different entrance requirements than the other master's programs offered by the Department of Operations Research. For further information call the Department of Operations Research at 676-6084.

Department of Engineering Administration (EAD)

The popularity of an advanced degree in management continues to increase, as a record number of off-campus registrants attests. Three hundred and ninety-five students have registered for the Spring 1985 program at nine centers in the Greater Washington area. These students are each taking an average of 1-1/2 courses during the spring term. All courses apply to the Master's Degree in Engineering Administration. The George Washington University's Engineering Administration Degree is one of the oldest in the nation (first awarded in 1958), and the program is currently one of the nation's largest.

Two new faculty members are being sought for the Engineering Administration Department's full-time staff. One faculty position will be dedicated to students pursuing Construction Management as an area of concentration. The other position will focus on the counseling of off-campus students and the coordination of the programs being offered off-campus. Candidates for these positions are invited to contact Dr. Robert C. Waters, Engineering Administration Department Chairman, whose campus phone is (202) 676-7409.


THE NUCLEAR NAVY.
RIDE THE WAVE OF
THE FUTURE.
You're deep under the sea. There are 4600 tons of nuclear-powered submarine around you. Your mission– to preserve the peace.
Your job– to coordinate a practice missile launch. Everything about the sub is state-of-the-art, including you.
The exercise– a success. You're part of that success and now you're riding high.
In the nuclear Navy, you learn quickly. Over half of America's nuclear reactors are in the Navy. And that means you get hands-on experience fast.
You get rewarded fast, too. With a great starting salary of $22,000 that can build to as much as $44,000 after five years. And with training and skills you'll use for a lifetime.
Then, whether you're in the Mediterranean, the Pacific or the Atlantic, wherever you move around the world, you'll be moving up in your career and in the Navy.
Find out more about an exciting future that you can start today.
See your Navy Recruiter or
CALL 800-327-NAVY.
NAVY OFFICERS GET RESPONSIBILITY FAST.

FOR YOUR INFORMATION

MECHELECIV encourages all students, alumni, faculty and staff of the School, and our other readers to contribute to or join the magazine and avail of this unique opportunity for organizational, journalistic and artistic experience, as well as receive exposure and recognition.
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